Management of mild and moderate head injuries in adults

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"Shock is a respite on the road with no return to death."
(John Collins Warren, 1842 - renowned American surgeon of the 19th century)

Abstract

Introduction: Craniocerebral trauma (CCT) is a major cause of morbidity and mortality world wide. In Romania, the trauma is the forth leading cause of mortality after vascular, neoplastic and digestive diseases and its coincidence continues to increase and this is explained by the development of transport infrastructure and by the increasing number of the motor vehicle and assaults. CCT consequences lead most of the time to invalidity, so the patients find it difficult to integrate in society or to return to their jobs, and the economic costs are high. Despite the fact that minor and moderate CCT appear frequently, their classification and management remain surprisingly controversial and pose problems due to the lack of agreement on definitions, of universal standardized guidelines, of insufficient studies and most importantly the lack of medical logistics and medical legal environment. Also, the absence of such guidelines increase the morbidity and mortality in patients with CCT due to the lack of information and prompt diagnosis and have high economic costs because of diagnostic tests and unnecessary hospitalization.

Objectives: Demonstrating the need for a protocol on minor and moderate management.

Material and methods: The study group included 91 patients (M/F 66/25) aged between 8 and 92 years, hospitalized in the Clinic of Neurosurgery in Iasi in the period 2004-2009.

The patients were clinically evaluated both at admission (GCS) and at discharge, imaging (CT) and it was followed up the etiology of CCT and the present symptoms.

Keywords: minor CCT, medium CCT, GOS, protocol, management.

Introduction

Head Injuries (HI) are a major cause of mortality and morbidity in the world.

In the United States, trauma is the 3rd cause of death after cerebral and cardiac vascular diseases and cancer (1); it has a worrying incidence of 200-400 cases per 100,000 inhabitants, of which Mild Head Injuries represents a percentage of 80% (2). In Romania, trauma is the 4th cause of death after cardiovascular diseases, cancer and digestive system diseases (3).

Studies conducted in the U.S. have shown that HI is the leading cause of death and disability in children and adults aged 1-44 years, and the moderate HI and severe HI are associated with an increased risk of Alzheimer's disease at 2.3 respectively 4.5 times higher than in healthy population. Also, men are 2 times more likely than

women to suffer an HI (4). Unfortunately, the HI hospitalization rate increased from 75% in 100,000 inhabitants in 2002 to 87.9% in 2003 (5). Development of infrastructure, industry, transport, increasing the number of vehicles, and military actions resulted in increasing the incidence of HI. HI consequences are more severe in women than in men.

The HI consequences are more severe in women than in men. The cause of these differences is not exactly known, but several factors have been incriminated to be related to the mechanism of injury, treatment variability and to different premorbid states related to gender (6).

Purpose and objectives of HI management guidelines

Unfortunately, despite that Mild Head Injuries are common, their classification and management remain surprisingly controversial being a constant dispute subject for physicians. As factors leading to these controversies, we can mention: the lack of agreement on definitions, the absence of standardized and valid universal guidelines for each country, insufficient studies in certain areas, lack of prospective randomized trials, and so forth (7).

Much of the variation in HI management strategies between the USA, Canada, Europe and Australia is driven by local issues such as the availability of resources and the medico-legal envirtonment. Thus the USA has higher rates of CT scanning for Mild Head Injuries compared to Canada, Europe (8).

Clinical guidelines may reduce unnecessary tests and hospital admissions for patients with Mild Head Injury as a helpful tool and not a substitute for medical thinking. They were designed for use by clinicians and neurosurgeons in both HI management, in major trauma services and also in regional and local hospitals.

The main objective of these guidelines is to reduce morbidity and mortality of adult patients with HI and avoid unnecessary diagnostic tests and hospital admissions, especially in patients with Mild Head Injuries. (9)

Definition of Mild and Moderate Head Injuries

Summary of closed head injury classification and outcome (10)

	Mild	**Moderate**	**Severe**
Initial GCS	14-15	9-13	3-8
% of total	80	10	10
Abnormal CT scan (%)	10-15	40-50	90
Neurosurgical intervention	1-3	10-15	40-50
Mortality (%)	<1	10-15	20-80
Good functional outcome (%)	>90	50	10-50

A Mild Head Injury is an injury suffered by a patient with a 14-15 Glasgow Coma Score (GCS) who arrives to the hospital after an injury without penetration (with or without a history of consciousness or memory loss). For classification of HI, the Glasgow scale is mostly used and evaluation should be made both initially and dinamically. Although intubation and sedation interferes with GCS, and in some cases its accuracy is only 75%, this scale still remains an important universal code in medicine (11).

Doctors have proposed changes to the GCS score with an increased sensitivity to Mild Head Injuries; for example, GCS-Extended (GCSE) or GCS 15, which defines the degree of post-traumatic amnesia (PTA) suffered by the patient. It's normal value should be between 0-7. If the period of amnesia is more than three

months, the score is 0, and if amnesia is present, the score is 7 (12). GCSE has three risk categories based on the results of CT and symptoms:

Low-risk: no symptoms or previous symptoms of dizziness, headache, vomiting

Intermediate risk: loss of consciousness or post-traumatic amnesia

High risk: severe headache, persistent nausea, vomiting ≥ 1 episode. (13)

Typical characteristics of Mild Head Injuries:

1. direct blow to the head or the mechanism of acceleration / deceleration
2. transient loss of consciousness or amnesia ⋆
3. transient changes of vigilance, behavior or cognitive function
4. rare neurosurgical intervention
5. post concussion symptoms are common
6. good long-term functional outcome

⋆ Amnesia after a HI is a predictive factor of intracranial complications. Retrograde amnesia is a more significant risk factor than anterograde amnesia. (14)

Risk stratification of HI is based on:

1. GCS on admission and for 2 hours post-injury
2. the duration of consciousness loss or amnesia
3. presence or absence of other specified risk factors

Most important clinical complications of Mild Head Injuries

Clinicians and patients should be aware of both the risk of neurosurgical intervention, and the risk of cognitive-behavioural sequelae following Mild Head Injury. They also need to consider that the absence of visible structural lesion on CT following Mild Head Injury does not exclude the possibility significant cognitive-behavioural sequelae.

Acute life-threatening complications that require neurosurgical intervention are rare in Mild Head Injury patients: low risk, 0-3% and high risk 0,5-6,5% of Mild Head Injury. (15) Post concussion symptoms are common in Mild Head Injury patients and may have significant cognitive-behavioural-social impacts on both patients and their families.

Typical post concussion symptoms include:

- headaches
- dizziness
- fatigue
- memory impairment
- poor concentration
- behavioural changes
- social dysfunction

Up to 50% of patients with Mild Head Injury may have significant post concussion symptoms that can persist several weeks. About 10% of patients with Mild Head Injuries will have persistent disabling post concussion symptoms.

The assessment of Mild Head Injuries (1)

Mild Head Injury patients should have a minimum of hourly observations for 4 hours post injury. These observations include: -GCS -alertness/behavior/cognition -pupillary reactions -vital signs
Serial neurological observations should be continued on any Mild Head Injury patients who fail to clinically improve at four hours post injury or who are found to have structural lesions requiring hospital admission.
Assessment for post traumatic amnesia (PTA) should be performed on any Mild Head Injury patients who fail to clinically improve at 4 hours post injury or who are found to have structural lesions requiring hospital admission.
Skull x-rays are not sufficiently sensitive to be used as a routine screening investigation to identify significant intracranial lesions.[1]
CT scanning is the most appropriate investigation for the exclusion of neurosurgically significant lesions in mild head injured patients.
CT scanning is indicated for those Mild Head Injury patients identified by structured clinical assessment as being at increased risk of intracranial injury.
If structured clinical assessment indicates the risk of intracranial injury is low, the routine use of CT scanning is neither clinically beneficial nor cost effective.

The need for CT scanning in Mild Head Injuries (16)

Initial assessment:	persistent GCS < 15 at two hours post injury
	focal neurological deficit
	clinical suspicion of skull fracture ⋆
	prolonged loss of consciousness >5 min
	prolonged anterograde or retrograde amnesia >30 min
	post traumatic seizure
	repeated vomiting ≥ 2 occasions
	persistent severe headache
	known coagulopathy (coagulability disorders, spontaneous hemorrhage, anticoagulation with warfarin or other anticoagulants)⋆⋆
	age >65 years (clinical judgment appropriate if no other risk factors present)

After a period of observation (4 hours post injury):	any deterioration in GCS
	persistent abnormal mental status (abnormal alertness, behaviour or cognition)
	any patient who fails to clinically improve
Clinical judgment required if:	age >65 years
	drug or alcohol ingestion
	dangerous mechanism/multi-system trauma
	dangerous mechanism of injury production (pedestrian accident, bicycle accident, ejection from vehicle, violent physical attack, traumatic fall of 1 m or more than 5 stairs, etc.) ⋆⋆⋆

⋆The risk of developing an intracranial hematoma is 12 times higher in patients with skull fracture radiographically evident than in those without. (16)

⋆⋆Although patients with coagulopathy are at increased risk of intracranial complications, recent studies have failed to recognize the importance of this link (2)

⋆⋆⋆The CHALICE Study 2006 (Children's Head Injury Algorithm) considers that a fall of more than 3 meters high is associated with more increased risk for the patient to develope an intracranial lesion.

Safe discharge of the patients (1)

Patients with HI can be discharged after a period of observation in the hospital, if they meet the clinical and social criteria:

Clinical criteria:	normal mental status and behaviour with clinically improving minor post concussion symptoms after observation until at least 4 hours post injury
	no clinical risk factors indicating the need for CT scanning or normal CT scan if performed due to risk factors being present
	no clinical indicators for prolonged hospital observation such as: -clinical deterioration -persistent abnormal GCS or focal neurological deficit -persistent abnormal mental status or behaviour -persistent severe post concussion symptoms -persistent drug or alchohol intoxication -presence of known coagulopathy (relative criteria) -presence of multi-system injuries (relative criteria) -presence of intercurrent medical problems (relative criteria) -age> 65 years (relative criteria)
Social criteria:	responsible person avaible to take patient home
	responsible person avaible for home observation
	patient able to return easily in case of deterioration
	written and verbal discharge advice able to be understood

Discharge advice criteria:	discharge summary for primary doctor
	written and verbal head injury advice given to patient: -symptoms and signs of acute deterioration -reasons for seeking urgent medical attention -typical post concussion symptoms

Initial management of Moderate Head Injuries (GCS 9-13) (1)

Standard care:	initial assessment of ABCDEs and resuscitation
	early CT scanning to identify neurosurgically correctable focal intracranial haematomas
	period of ED observation
	prevention of secondary brain injury by avoiding hypoxaemia (O2 saturation < 90%) and hypotension (systolic BP <90)
	supportive care of ABCDE's
	admit for prolonged hospital observation (24-48 hours) unless rapid clinical improvement, normal CT scan and absence of other risk factors
	early neurosurgical consult if not clinically improving and/or abdnormal CT scan
	routine post traumatic amnesia (PTA) testing
Outcome:	approximately 80% of Moderate Head Injuries improve while 20% deteriorate and required management as per severe head injuries
	the majority of patients who suffer Moderate Head Injuries will have some degree of cognitive-behavioural sequelae and should be considered for routine follow-up with a brain injury rehabilitation service or a neurologist

HI patient transfer to a neurosurgery service

Patients with Severe Head Injuries (GCS 3-8)	
Patients with Moderate Head Injuries (GCS 9-13), if:	clinical deterioration
	abnormal CT scan
	normal CT scan but not clinically improving
	CT scan unavailable
Patients with Mild Head Injuries (GCS 14-15), if:	clinical deterioration
	abnormal CT scan
	normal CT scan but not clinically improving
	high risk Mild Head Injury with CT scan unavailable

The transfer of patients with brain injuries is potentially dangerous if it is poorly done and, therefore (2), any HI must be correctly diagnosed so that, between the onset and neurosurgical intervention, no more than four hours should pass. (3)

The purpose of this study was to demonstrate the necessity of a protocol in the management of minor and medium CCT.

Methods and materials

The study was based on a retrospective study on a group of 91 patients hospitalized in the Clinic of Neurosurgery in Iasi in the period January 2005 – December 2009.

The patients selected were aged between 8 and 92 years (the average age is 52) and the male-female ratio was 66:25 cases. The patients were clinically evaluated both at admission (GCS) and at discharge, imaging (CT), and it was followed up the etiology of CCT, the present symptoms (headache, intracranial hypertension, impaired consciousness, and focal neurological deficit) and the duration of hospitalization.

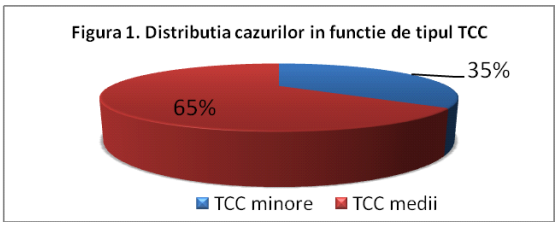
The patients who presented other organs' involvement and systems, as well as patients who had preexisting medical conditions were excluded.

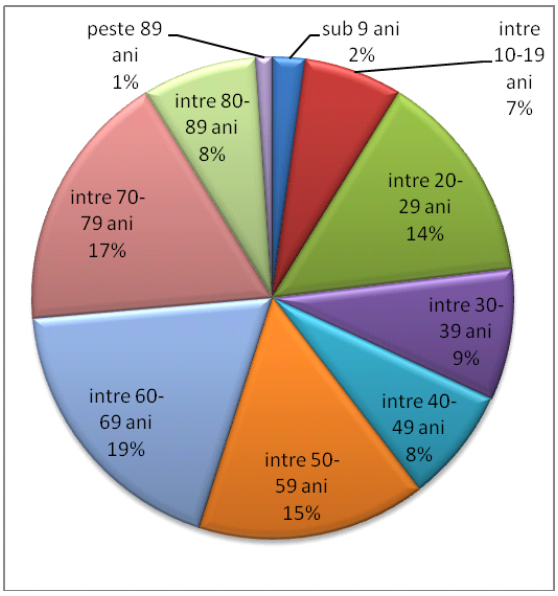
Results and discussions

All the 91 patients were evaluated on admission by GCS: 35% were minor CCT (GCS scale 14 and 15) and 65% were moderate CCT (GCS scale 9-13). The predominance of moderate CCT was convenient to us in our analysis to see if they have not been overrated by the neurosurgeons (Figure 1).

A percentage of 73% patients of our group were man (66 cases) and only 25% women. Also, the literature confirms that the incidence of CCT in men is twice higher than in women.

If we take a look at every 10-year age group, we can observe a uniform distribution of the cases, except for those over 89 and under 9 years, which represents 3% of CCT. 19% of the patients with CCT belong to the 6th decade, followed by the low percentage of the 7th decade (17%), 5th (15%) and 2nd (14%). It seems that the highest incidence is met at patients aged between 50 and 80 and this represents half of the total number of TCC. The 14% percentage of CCT for patients aged 20-29 could be explained by more intensive activities in this period.





From the distribution of the etiology of CCT, 41.7% of the patients were hospitalized for falling on same level, followed by those with car accidents and high level falling (approximately 21.9% and 19.7%).

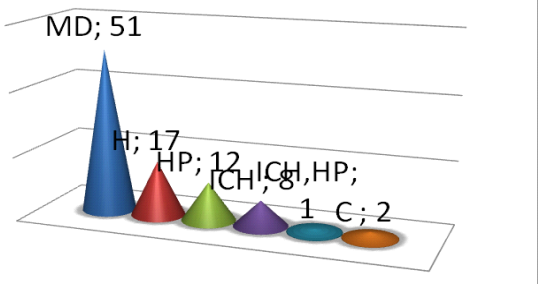
Only 15 patients of a total of 91 came to the hospital as a consequence to physical aggression. In current practice, high level falling is usually associated with moderate or severe CCT, while falling on same level is not associated with moderate or severe CCT.

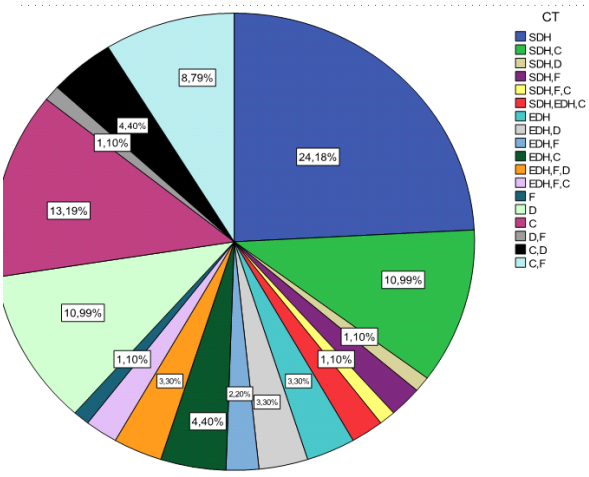
This mantrap in which the patient's age, the symptoms at admission / in dynamic or CT changes are not taken into account, but only the mechanism of CCT, makes moderate CCT to be overrated or even worse, minor overrated CCT could lead to risks and adverse consequences for the patient. The prevalence of CCT caused by falling on same level (41.7% of CCT) was convenient in our analysis since this segment of etiologies of CCT causes the most confusion.

56% of the patients had MD at admission and 19% presented headache. Only 9 patients (10%) displayed signs of ICH.

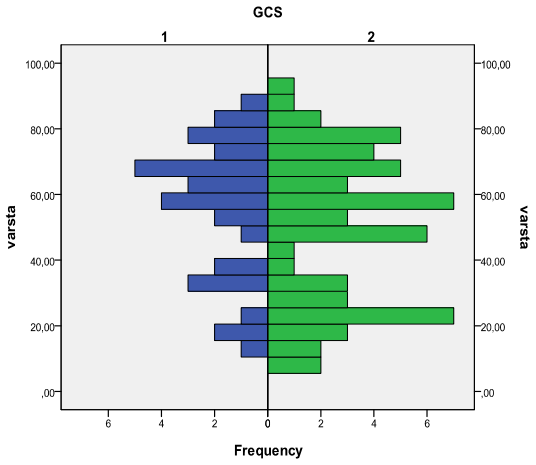
After CT scan, it has been discovered at about a quarter of all patients (24.18%) the presence of a subdural hematoma combined with other injuries, at 13.19% there signs of cerebral concussion and in an equal percentage of 11% there were patients with subdural hematoma, with concussion and cerebral laceration respectively.

Figura 3. Distributia cazurilor in functie de simptomatologia la internare



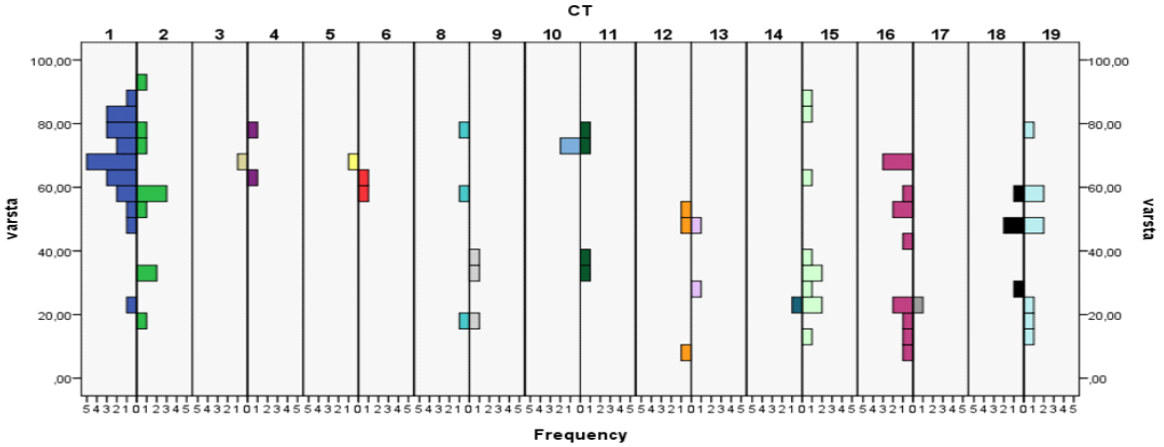


Depending on their age, minor and medium CCT have a similar distribution, except for some peaks of moderate CCT in the 2nd and 5th decade.



Distribution of cases according to CT aspect

After the correlation between the patient's age and the results of the CT scan, the differences are statistically significant ($p<0.01$). That means that the patients of the same age, same type of injury have different CT scan results.



After correlating the etiology with the symptoms, I have found significant statistical differences ($p<0.05$). This reveals that the etiology of CCT has different symptoms. Regardless the etiology of trauma, MD has been prevailingly the main symptom, followed by headache and hemiparesis.

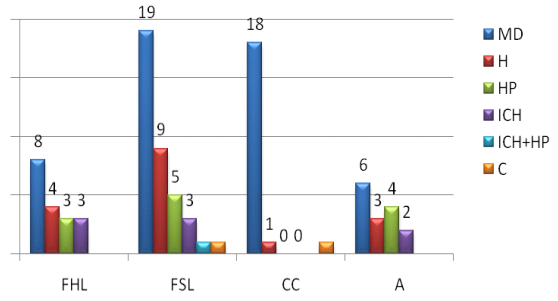
After the correlation between the symptoms and the GCS evaluation, the differences are statistically significant ($p<0$, 01). The "error" is given by the fact that the GCS evaluation does not take into account the motor or speech deficits which could also influence the final result.

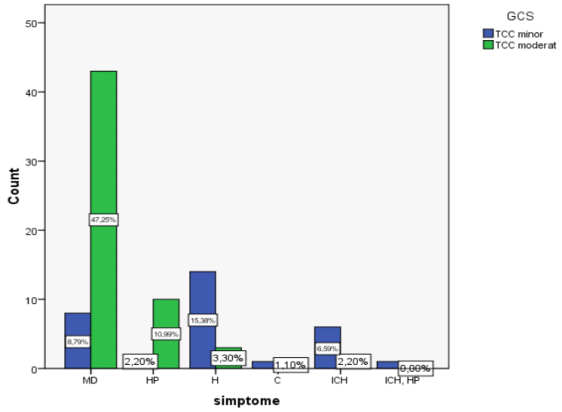
There have not been significant statistical differences after the correlations made between the symptoms and the GOS. At discharge, the majority of patients with MD had GOS 1, 2 or 3.

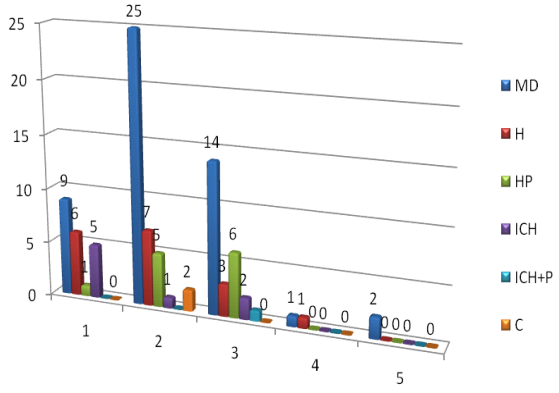
At discharge, it has been discovered that most patients were evaluated with GOS 2 (44%), followed by patients with GOS 3 (29%) and GOS 1 (23%). Two patients with moderate CCT died (GOS 5).

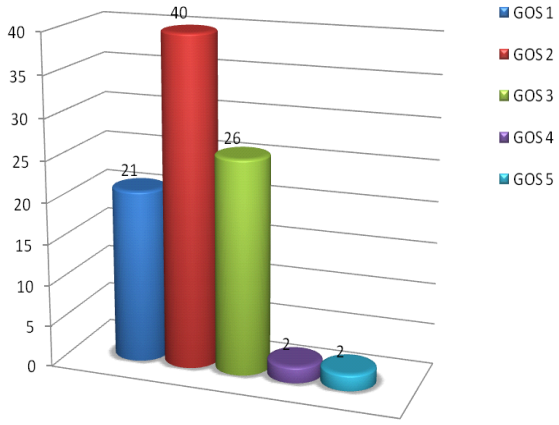
At discharge it has been discovered that most of the patients with minor CCT (78%) had GOS 1 and GOS 2 (12, respectively 13 patients). In the case of moderate CCT, only 15% (9 patients) of the patients recovered completely (GOS 1), most of them with GOS 2 (46%) and GOS 3 (36%).

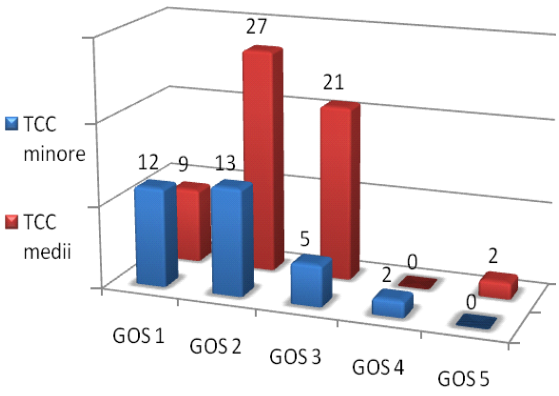
Most patients have GOS 1, 2 and 3 respectively.



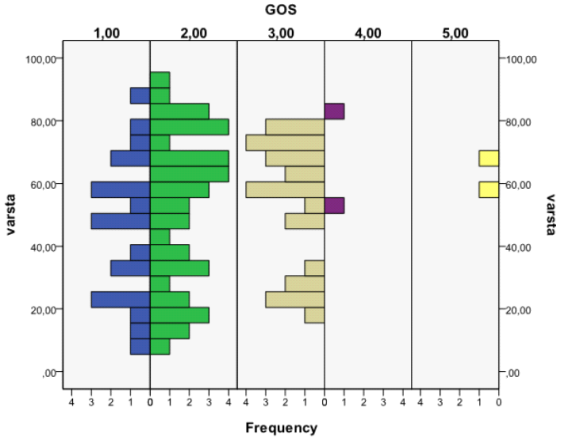








Regarding the average length of hospitalization, I have discovered that the medium is 14-15 days for minor CCT and 15-42 days for medium CCT. The average length of hospitalization extremely close as value raises issues, confirming once again the consequences of the lack of management guidelines: morbidity and mortality of patients with CCT due to the lack of prompt recognition and diagnosis, of diagnostic tests and unnecessary hospitalizations and therefore, high economic costs.



Conclusions

Based on the results, I have discovered that minor CCT evolution is influenced by the precocity of diagnosis, the elimination of unnecessary time for diagnosis and the establishment of proper treatment and this conduct can be set by introducing some protocols which can be adapted to real possibilities of each region.

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